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## Conducting a Transient-State Anaerobic Digestion Process at Start-up Phase of a Biogas Plant

Teodor Vintilă<sup>1</sup>, Teodora Toader<sup>1\*</sup>, Dana-Iuliana Neață<sup>1</sup>, Monica Cristina Dragomirescu<sup>1</sup>, Călin Julean<sup>1</sup>

**Abstract:** The digester from on-farm biogas plant from Timisoara were incorrectly fed during the start-up phase with high organic contents feedstock. This situation contributed to an imbalance of the production. During a two-months period of monitoring and conducting the anaerobic digestion process, a steady state of the biotechnological was reached. Subsequently, mixture recipe for feeding the digesters after reaching the neutral pH and the maximum FOS/TAC value of 0.4, have been established according to the materials available on the farm.

**Keywords:** anaerobic digestion, biogas plant, start-up, transient-state process

### • Introduction

In Romania the biogas sector (11 biogas plants in operation in the entire country in 2022) needs a sustained growth to reach a similar size, considering the potential of our country to deliver necessary feedstock to produce biogas/biomethane.

Our team contributed to restart an anaerobic digestion process in a biogas plant where the biologic process was stopped because of technical issues.



### • Material and method

**Table 1.** Values of main parameters in digester no. 1 (D1) at the beginning of the research

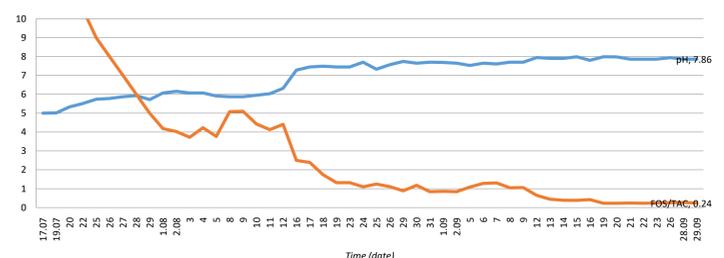
	pH	DM	ODM	FOS/TAC	Semification of main operation parameters
Values in Digester no.1	5.00	6.2	5.3	296 !	FOS/TAC ≥ 0,6 – too much undigested organic mater, feeding must to be stoped!
Optimal values	7.5-8.5	8-11	7-10	0.4-0.2	Bioprocess is in steady state, continuously producing biogas

The digestion process is in collaps, the fed material is not degraded, the microorganisms are not active.

A first measure to restore the balance of the biological process would be to feed the reactor with fresh cow manure. Our team proposed to dramatically reduce the feeding rate of the reactors to let the microbes consume the excess organic acids built up from overfeeding.

At this FOS/TAC the accumulation of volatile organic acids is evident, which lowers the pH and inhibits the methanogenesis process. A first measure to restore the balance of the biological process would be to feed the reactor with fresh cow manure.

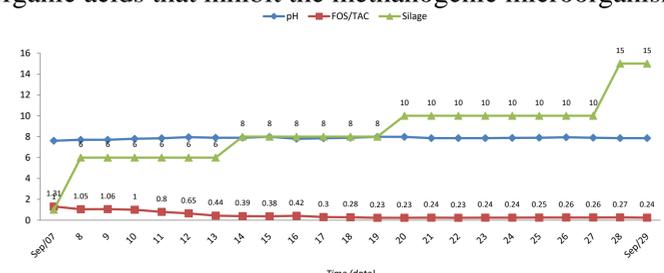
### • Results and discussions



**Figure 2.** Evolution of pH and FOS/TAC parameters in start-up period of the anaerobic digestion

After the addition of 10 tons of calcium carbonate in two stages in the first week of August, after another two weeks, in which the feeding of the reactor was stopped, the FOS/TAC value dropped to 2.5, and the pH reached the threshold value of 7.

After laboratory analyses, it was established that manure add considerable amount of organic acids that inhibit the methanogenic microorganisms.



**Figure 3** Evolution of pH and FOS/TAC parameters in start-up period in condition of increase feeding of carbon-rich substrate (corn silage)

In October 2022, the feeding rate of the biogas plant increased to 124 m<sup>3</sup> of cow manure and 25 tones / day of corn silage and the production efficiency of the cogeneration unit reached 72% (the power of 720kW from the total installed power of 1 MW of the cogeneration unit).

To increase economics of the process, it is recommended to feed the digester with residual raw materials, available at zero costs in the area of the biogas plant operator.

### • Conclusions

Mixture recipe for feeding the digesters after reaching the neutral pH and the maximum FOS/TAC value of 0.4, have been established according to the materials available on the farm. Cow manure will constitute the main substrate with important microorganic input and maize silage is available as substrate with high energy input and will constitute the main energy feedstock to produce biogas and green energy.

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